

Short-term (2-month) Effects of a CHW-delivered Intervention for Improving
Smoking Hygiene Behaviors among Parents of Children under 5 in Rural China: A

Mixed Method Study

by

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Thesis submitted in partial fulfillment of
the requirements for the degree of
Master of Science in the Graduate Program
in Global Health in the Graduate School of
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ABSTRACT

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Abstract

Background: Secondhand smoke (SHS) exposure has direct adverse health impacts, especially among young children. With high prevalence of smoking in rural China, children were faced with severe SHS exposure within households. The aim of this study is to investigate short-term (2-month) effects of a community-based smoking hygiene intervention. Method: To adapt an evidence-based intervention packet, we interviewed residents of the target community via focus group discussion. Community health workers (CHWs) and village doctors (VDs) were trained as counsellors to implement the intervention. A follow-up assessment was conducted to compare the differences between subjects in the intervention and control group in regard to their smoking behavior and household smoking hygiene practices. Relevant health workers were interviewed to learn their experience of delivering the smoking hygiene intervention. Result: We found that the intervention had minor effects on smoking cessation among the subjects (7.7% vs 7.3%, $P=0.91$); while smokers who received the counselling (78.9% vs 45.2%, $P<0.001$) were more likely to make changes in smoking behavior at home or around their children. Conclusion: It was feasible to reduce children's SHS exposure through community-based programs. However, our intervention showed no positive impacts on smokers' quitting and thus more studies were expected to explore effective methods for smoking cessation intervention. To have health workers from primary health centers engaged in future projects, researchers should consider the workload and improve their job satisfaction.

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1. Introduction

Exposure to secondhand smoke (SHS) among young children has been a major public health concern (Sheahan & Free, 2005). SHS is the combination of smoke emitted from the burning end of a cigarette or other smoked tobacco products and the smoke exhaled from the lungs of smokers (Warren et al, 2009). A large and accumulating body of scientific evidence has confirmed the negative impacts of SHS on infant and child health. The US Surgeon General (2006) concluded that there was no risk-free level of SHS and even a brief exposure could cause harm. Globally, exposure to SHS was responsible for an estimated 600,000 deaths and almost 11 million disability-adjusted life-years (DALYs) per year; and among all cases, children made up over a quarter of deaths and over half of DALYs associated with SHS exposure (Oberg et al, 2011). Young children and infants who are exposed to SHS have higher risk for respiratory disorder, including asthma, bronchitis and pneumonia (Gilliland, Li & Peters, 2001). Acute lower respiratory infections are the leading cause of morbidity and mortality in children under five years of age (Sonego et al, 2015). Over 95% of these deaths occur in low- and middle-income countries (LMICs) (Liu et al, 2012).

China is one of the largest producer and consumer countries of tobacco in the world with an estimated 301 million current smokers in 2010 (Li, Hsia & Yang, 2010), and the trends in tobacco consumption continue to increase. More than 90 per cent of the Chinese smokers reported smoking in public spaces (Li & Chen, 2008), resulting in 740 million non-smokers passively exposed to SHS, including 180 million children under 15 years old (Liu & Chen, 2011). Certain cities have established local regulations to control tobacco use ahead of national

policy since China acceded to the World Health Organization Framework Convention on Tobacco Control (WHO FCTC) in 2005 (Xu et al, 2015). For example, Shanghai has enforced the Public Places Smoking Control Legislation since 2010 and initial positive effects including decreased SHS exposure in the population level were reported (Li et al, 2013).

Socioeconomic status influences tobacco use with higher consumption among the poor and those with less education (Palipudi et al, 2012). Children living in socioeconomically disadvantaged communities are at higher risks of SHS exposure, as their parents are more likely to smoke (Sims et al, 2010) and their homes have fewer smoking restrictions (Phillips et al, 2007). In China, with 70 per cent of the population living in the countryside, Cai et al. (2014) argued there was disparity between rural and urban areas regarding the prevalence rate of smoking and SHS exposure. Particularly, smoking prevalence was higher among rural residents (29.8%), compared to urban residents (26.1%) (WHO, 2010). Yao et al. (2012) reported SHS exposure rate among nonsmoking children (aged 0-18) was 68% based on the study they conducted in 6 rural areas in China. Whereas, a national survey among adults in 2013 revealed that the awareness of health risks related to SHS exposure was 60.0% in rural areas, lower than the rate in urban areas (77.0%) (Li et al, 2017).

Home has been the predominant location for children's exposure to SHS (Merom & Rissel, 2001). An estimated 40–50% of the world's children are regularly exposed to SHS, primarily by being around smoking parents and/or other household members (Oberge et al, 2011). The issue of SHS exposure among infants and young children due to parental tobacco use is even more prominent and severe in China. According to the Global Adult Tobacco Survey (GATS) in 2010, the overall exposure to SHS in the home among children younger than 15 years was

66.7% in China (Mbulo et al, 2016).

Young children are more vulnerable to being exposed to SHS than adults since they are often unable to change the circumstances that lead to their exposure. Therefore, caregivers' decisions regarding smoking behaviors at home strongly influence the SHS exposure levels of young children. In order to protect children from adverse health consequences of SHS exposure, measures to restrict smoking at home need to be introduced (Mittal & Das, 2011). The American Academy of Pediatrics (2001) has recommended proper smoking hygiene (i.e. smoking away from the immediate environment of infants and children) to eliminate children's exposure to SHS and improve child health. Additionally, evidence from previous studies showed that smokers who had implemented household smoke-free rules than those who did not implement such a rule were significantly more likely to make a quit attempt, be abstinent and smoke fewer cigarettes per day (Mills et al, 2009).

Research gap

Although a growing literature demonstrated the effectiveness of strategies to increase the delivery of smoking cessation treatment in primary care, these studies were conducted almost exclusively in high-income countries (HICs) (Papadakis et al, 2010). Also, with a dearth of studies designed to examine the prevalence of home smoking bans in China (Ji et al, 2009), very little was known about smoking behaviors of Chinese smokers when they were in the home (Berg, Zheng & Kegler, 2015).

Promoting household smoking bans is a prominent strategy for protecting the health of young children (Kegler et al, 2007). Although Cramer et al. (2007) suggested to develop community programs that helped eliminate exposure to SHS by increasing public support for tobacco-free

policies, there were few community-level interventions (Escoffery et al, 2017). In a recent systematic review, out of 57 intervention studies aimed to reduce SHS exposure of children, only 7 studies were based on community settings (Baxi et al, 2014).

As primary healthcare systems in LMICs were strengthened, community health workers (CHWs), defined as any health worker carrying out functions related to health care delivery that are trained in some way in the context of the intervention, were increasingly recognized as an integral component of health workforce needed to achieve public health goals (Kok et al, 2015). Lewin et al. (2010) claimed that CHW could effectively deliver key maternal and child health interventions. Many countries around the world have conducted pilot community programs with the aim of addressing the problem of SHS exposure (Alwen et al, 2011; Mittal & Das, 2011; Kegler et al, 2012). However, with the primary message focusing on smoking cessation, few community-based intervention studies have examined how to effectively increase the adoption of household smoking bans (Gehrman & Hovell, 2003).

China has established community-based primary health care system that can be a key channel for providing health education services to parents of young children. The previous study has shown the success of implementing a SHS exposure reduction intervention for children in Shanghai by engaging community health centers (Abdullah et al, 2015). The evidence promises the feasibility of developing CHWs-delivered educational interventions to reduce SHS exposure from household smoking and improve respiratory health of children in rural areas of China. However, it is not clear whether a theory-based intervention that was proven effective among the urban households will be acceptable among rural residents. In rural communities, village doctors (VDs) are responsible for health education and promotion (Yan et al, 2014; Tang

et al, 2015). There were a few community-based health intervention projects in rural settings while most of them targeted on non-communicable diseases (NCDs) prevention or management.

Study aim & objectives

The overall aim of the study is to examine the short-term (2-month) effects of a CHW-delivered educational intervention (i.e. smoking hygiene intervention, SHI) to reduce SHS exposure among children in rural China. There are four research objectives:

1)To explore parents' or caregivers' smoking behaviors and smoking hygiene practices around children under 5 in rural communities of China;

2)To adapt the existing SHI for rural Chinese and generate a context-specific (i.e. rural China) intervention packet named SHI-R;

3)To compare differences between intervention and control groups regarding participants' changes in smoking behaviors and smoking hygiene practices at 2-month follow-up;

4)To explore experiences of CHWs in delivering the SHI-R and seek for their suggestions to further improve the SHI-R.

2. Method

2.1 Overview

The research was conducted within an ongoing randomized trial (RCT) (i.e. RESCUE Study) which aimed to examine the effects of a CHW-delivered intervention to reduce SHS exposure among young children and promote parental quitting in rural China. To assess short-term (2-month) effects of the adapted intervention, a mixed method study was conducted in Taizhou, Zhejiang. Baseline assessments for the RESCUE Study were completed in April 2018.

Our study contained three stages: 1) Intervention development: to adapt the SHI that was effective in a previous study (Abdullah, et al 2015) among urban Chinese, we conducted focus group discussions (FGDs) among members of one target community. 2) Intervention implementation: counselling sessions (both face-to-face and via-telephone contacts) of smoking cessation and smoking hygiene were delivered by trained community health workers (CHWs) during May to July 2018. 3) Evaluation: we conducted a follow-up assessment at 2 months (July 2018) to measure differences in smoking cessation and household smoke hygiene practices between subjects of control and intervention groups; on the service delivery side, we interviewed CHWs individually to explore their experiences in delivering the SHI-R and seek suggestions for improving the intervention design.

2.2 Setting

The study was conducted in Taizhou, located at central Zhejiang province. Zhejiang is an economically developed region in eastern China. In 2017, the per capita GDP of Taizhou was ¥72,912 (~10,500 USD) (Taizhou Bureau of Statistics, 2018). High SHS exposure at home

(60.9%) and in public (65.3%) was reported in Zhejiang (Xu et al, 2012). With the aim of building a health-first and people-oriented culture, the local Centers for Disease Control (CDC) has implemented a number of campaigns to provide knowledge about tobacco to the public and promote a non-smoking social atmosphere (Xu et al, 2016).

Rural population accounted for 37.8% of the total population of Taizhou (Taizhou Bureau of Statistics, 2018). The terrain of Taizhou is characterized by mountains that contributes to the scattered distribution of villages. In rural areas, the major economic activity is agriculture. To seek better job opportunities, it is common for younger generations to work in other districts or cities. Four communities were selected to participate in the study: 1) Luoyang and 2) Tongyu subdistricts in Luqiao District; 3) Hetou and 4) Yongfeng towns in Linhai city.

2.3 Participants

2.3.1 Focus group discussion

To better understand smoking patterns and perceptions of a smoking cessation and tobacco exposure reduction intervention (i.e. SHI), we conducted focus group discussions (FGDs) in Linhai city. To avoid contamination, participants of FGDs were not recruited for the main intervention study. Eighteen residents of the community were recruited. The eligibility criteria included: 1) being a smoker or 2) having at least one family members who was a smoker. Participants were recruited via an online poster shared on WeChat Subscribed Articles (a Chinese social media platform), whereby people could register for the FGDs. A coordinator from the local CDC assisted with the recruitment process.

2.3.2 Randomized controlled trial

The RESCUE Study evaluated the effect of the adapted SHI. Two communities were purposively assigned to the intervention and two communities to comparison group. Inclusion criteria were: i) households that included at least one child under the age of 5 and at least one active adult smoker (smoked one or more cigarettes daily for the past 30 days); ii) smoking household member and the child were living together in the same household and would live together during the research period; iii) residents of the study community; iv) able to communicate in Mandarin Chinese. If there were more than one smoker in one household, the primary caregiver was selected for study participation. Smokers who reported not smoking in the home or in front of their children were excluded. 461 subjects completed the baseline survey and were enrolled to receive the intervention.

2.3.3 Individual interview

All community health workers (CHWs) in charge of delivering the SHI-R (i.e. counselling about smoking cessation and smoking hygiene) were invited to participate in an individual interview. There were 12 CHWs in total and 10 of them agreed to join the interview and talk about their experience in intervention implementation.

2.4 Procedure

2.4.1 Baseline assessment

Within the four selected communities, assigned CHWs screened eligible households and invited them to participate in the intervention study. Interviewers were students recruited from local colleges who received training for half days (~4 hours). The topics covered in the training included: responsible conduct of research, basic information about the study and general

interview strategies. Interviewers, accompanied by CHWs, visited households that agreed to take the survey and be enrolled in the intervention. The intention of the study was stated and follow-up events (including intervention and follow-up assessments) were discussed. Subjects were informed that they could drop out of the study at any stage. After confirming subjects' informed consent, interviewers completed a baseline assessment of the household (involving a smoker and a main caregiver).

2.4.2 Adaptation of the smoking hygiene intervention

Theoretical construct: The SHI was developed based on the protection motivation theory (PMT) (Rogers, 1975). PMT assumes that the provision of knowledge works to change behavior when motivation for change is present. When environmental or personal factors are a threat, like SHS exposure to children's health, decisions regarding coping responses to this threat are made as a result of balancing the costs and benefits of the threats with those of the protecting behavior. Increased perception of risk has been shown to be associated with healthier behaviors (Brewer et al, 2007). The model has been used to predict smoking behavior among Chinese young adults in several studies (Macdonell et al, 2013; Yan et al, 2014).

To adapt the existing intervention package that was previously used in urban China (i.e. Shanghai) to fit the research setting, qualitative data were collected to inform the intervention for use by rural Chinese. Prior to implementation, FGDs were conducted among members of smoking households. 9 males and 9 female participants were recruited and assigned to three 6-person groups. Written informed consent was obtained from each participant before the discussion started. All three FGDs were moderated by the same researcher with a notetaker, that were held in one day at Linhai CDC. Each discussion lasted for approximately 60 minutes.

The moderator followed a semi-structured interview guide. All the discussions were conducted in Mandarin Chinese and recorded by digital voice recorder. To compensate participants for their time, a cash amount of 100 RMB (~15 USD) was given to each participant.

2.4.3 Implementation of the intervention

Intervention component

Based on feedback from FGDs, a revised smoking hygiene intervention packet that was to be used in rural China was generated and named SHI-R. As a clustered RCT study, the two communities in the same area (Luqiao or Linhai) were randomly assigned to either smoking hygiene group (i.e. intervention group) or health material group (i.e. control group). Subjects in the intervention group received information about smoking cessation and household smoking hygiene practices, while the control group received information about child development.

The intervention was delivered by CHWs in the form of counselling (including face-to-face and telephone sessions). The initial contact was a face-to-face home visit, lasting for about 30 minutes. One week, two weeks, two months, and four months later, subjects were followed up respectively via a 15-minute telephone counselling. Another in-person contact was scheduled at one month after the first visit. The overall intervention lasted for 6 months and the RESCUE Study was completed in December 2018. This study only examined the short-term effects of the intervention at the end of 2-month.

Training of CHWs

CHWs received a one-day training that covered information about the study and intervention, general counselling strategies, and research ethics (e.g. responsible conduct of research). Training for CHWs of intervention groups and control groups were conducted separately. Each

CHW received a manual that included all the study and reading materials. CHWs for delivering smoking hygiene intervention learned knowledge about smoking and SHS, strategies for smoking cessation, and suggestions for reducing SHS exposure among children. CHWs from control groups learned how to care for children's growth and development before the age of 5. A mock session observed/supervised by a research staff was scheduled after general lectures to let CHW practice the intervention or control components.

Quality control

To control the quality of counselling, CHWs were requested to keep records of each contact using a standard, previously developed checklist. A manual with detailed instructions for counselling was used by CHWs for intervention delivery. At first, every CHW was accompanied by researchers for at least three visits to help them get familiar with the counselling process and ensure the quality of their performance.

2.4.4 Two-month follow-up assessment

A follow-up assessment was conducted to examine effects of the SHI-R in changing subjects' smoking behavior and smoking hygiene practices two months after the initial contact. There was no significant difference between the procedure of baseline and follow-up assessment. Trained interviewers visited the household that had received the intervention. Loss-to-follow-up subjects and the reasons were recorded. Participants who reported not living with their children (less than 4 days a week) in the past two months were excluded.

2.4.5 Individual interviews with CHWs

The aim of individual interviews was to understand CHWs' experience in intervention implementation, especially the challenges they encountered. CHWs who delivered the SHI-R

were interviewed at their workplaces after completing all scheduled contacts (i.e. 2 in-person and 3 via-telephone sessions) by the end of two months. The interviews were conducted by the same researcher in Mandarin Chinese. A structured guide was used to facilitate the talks. Each interview lasted for approximately 20 minutes and was audio recorded.

2.4.6 Ethical approval

The RESCUE Study was approved by the ethical review boards at Duke Kunshan University in 2016 (No: 2016ABDU003). Amendment to the protocol was approved by the Duke Kunshan University Institutional Review Board (No: 2018PAN007).

2.5 Measures

2.5.1 Baseline measures

A structured questionnaire was used for the baseline assessment. The measures were developed with reference to the questionnaires used in a previous study (Abdullah, et al 2015). A household questionnaire contained two parts. Part I was completed by the smoker regarding basic personal information, smoking status, household smoking behavior, household smoking regulations, knowledge about tobacco use and attitudes toward smoking, and past quitting attempts. Part II was filled out by the main caregiver of child regarding basic personal information, smoking regulations, knowledge about tobacco use and attitudes toward smoking, and child's health status. If the smoker was the same person as the main caregiver, then he/she would only need to answer questions about the child's health in Part II.

2.5.2 Outcome indicators

The effects of intervention were measured by self-reported behavioral changes of the subject

(i.e. smoker) regarding smoking cessation and smoking hygiene practices in the household. A structured questionnaire, consisting of two parts as the baseline, was used to assess the outcomes. Smoking cessation referred to i) quitting smoking (abstinence and quitting attempts during the 2-month period) and ii) reducing amount of smoking (number of cigarettes smoked daily). Household smoking hygiene practices referred to i) smoking around children, ii) smoking inside the house, and iii) establishing smoking restriction at home. In the intention-to-treat analysis, we treated the loss-to-follow-up subjects as a failure in regard to the outcome variables.

2.5.3 FGD and individual interview guides

The guide for FGDs (see appendix A) included two domains: i) patterns of smoking behaviors and smoking hygiene practices in the community; and ii) suggestions for revising the existing SHI. In the first part, participants were asked about the reasons for smoking, quitting, or relapsing (if ever); knowledge about harm of smoking and SHS; concerns about children's exposure to SHS; barriers to smoking cessation and establishing smoke-free regulation at home. In the second part, participants were briefly introduced to the design and components of the SHI. They were then invited to provide any advice for arrangements of the intervention contacts and content of the counselling.

Individual interviews were aimed to learn about CHWs' experience in the process of delivering the SHI-R. A structured interview guide was developed (see appendix B), including questions about if the workload was manageable; what challenges CHWs met for counselling sessions; what responses CHWs received from the subjects; how CHWs perceived their role in community-based health interventions; and CHWs' suggestions for improving the design of

SHI-R and promoting future interventions.

2.6 Analysis

2.6.1 Quantitative data

Analysis of quantitative data was performed by StataSE 14. Characteristics of the subjects (i.e. smokers) collected at baseline were summarized using descriptive statistics. We presented means and standard deviations for continuous variables; counts and proportions (excluding missing values) for categorical variables. To compare intervention and control groups at baseline and detect differences in smoking behaviors and household smoking hygiene practices, we used independent t tests for continuous variables and Chi-square tests for categorical variables. Statistics values of tests and their corresponding P values were reported. A P value of $<.05$ was regarded as significant.

To assess effects of the intervention at 2 months, only the subjects that were available for follow-up were included. We used logistic regression model to adjust for the indicators that were significantly different between intervention and control groups at baseline. Variables included in the model were transformed into binary forms. Odds ratio (OR) with 95% confidence intervals (CIs) were calculated and presented for the outcome measures. All data used in the analysis were measures in part I of the questionnaire, namely reported by the smoker.

2.6.2 Qualitative data

Notes taken during FGDs were reviewed immediately and discussed among the research team after the sessions and the data in regard to suggestions for adapting the intervention design were extracted to inform generation of the SHI-R. Audio recordings for both FGDs and

individual interviews were transcribed verbatim. Transcripts were coded by the author using NVivo 12. Structural codes generated from the interview guides were first applied to segment the text, with input from the research supervisor and peers. Transcripts were read carefully to mark evidence that supported the findings and check for any missing message. Key themes were identified through the process of coding, supplemented by notes taken during the discussions or interviews, to answer the research questions. The coding process were conducted in English but using transcripts in the source language of Mandarin Chinese in order to retain the original meaning. Quotes presented in the results section were extracted and translated into English verbatim by the author.

3. Result

3.1 Focus group discussion to adapt SHI

We conducted three FGDs in Linhai, Taizhou. Each group was composed of 6 participants. 18 residents (9 males, 9 females) from local communities were recruited (Table 1). Participants were recruited from smoking households (i.e. either participants were smokers themselves or at least one of their family members was a smoker). Among the participants, there was one current smoker, three ex-smokers (smoked in the past but now had quit), and two that reported to have ever tried cigarettes at young ages.

Table 1. Characteristics of FGD participants (3 FGDs, N=18)

Characteristics		Group 1 (n=6)	Group 2 (n=6)	Group 3 (n=6)
Gender	Male	2	4	3
	Female	4	2	3
Age	Mean \pm SD	37.2 \pm 9.7	40.3 \pm 11.6	41.2 \pm 7.6
	Range	29-52	34-58	31-50
Education	College and above	5	5	4
	High school and below	1	1	2
Smoking status	Currently smoking	/	/	1
	Used to smoke	1	1	1
	Ever used cigarettes	1	1	/
	Non-smoker	4	4	4

The FGDs contained two domains: i) smoking patterns in the community and perceptions of smoking and ii) adapting the existing intervention packet. Responding to the first domain, five main themes emerged (see appendix C): perceptions of smoking, concerns about secondhand smoking (SHS) or third-hand smoking (THS) exposure, household smoking status, challenges of smoking cessation, and barriers to household smoking restriction. Suggestions for adapting the SHI were discussed immediately after the FGD sessions among the research team and used to inform revision of the intervention design.

Perceptions of smoking

Smoking was perceived as a common practice in rural areas in Taizhou. Each participant reported to know a few smokers. Also, the convention exists that cigarettes are distributed during social activities, such as wedding parties. In business occasions, cigarettes are distributed as a way of showing kindness.

However, with a bad impression of smoking, harmful to health and unpleasant smell, smokers were sometimes unwelcomed, especially by females. In the FGDs, both smokers and nonsmokers showed negative attitudes towards smoking behavior and smokers.

“If you live in rural areas, everyone around you smokes so that you are viewed as weird if you do not smoke.” (Female, 33)

“I have a friend who smokes while his girlfriend [who dislikes smoking] asked him to quit. He did not listen, and therefore they broke up.” (Ex-smoker, male, 58)

All participants were familiar with the statement that “smoking damages health”. Mostly, they mentioned smoking might cause coughing, respiratory diseases, and lung cancer. One participant (male, 35) shared his experience that he tried smoking out of curiosity when he was young, but as he received more health education and realized smoking was harmful, he no longer used cigarettes.

Concerns about SHS/THS exposure

Secondhand smoking (SHS) was widely known in the community, also called as passive smoking, while few participants learned about third-hand smoking (THS). However, some participants pointed out the issue of “smell of smoking” that reflected their awareness of THS.

“There is a smell of smoke when smokers pass by.” (Nonsmoker, male, 52)

Most participants realized the fact that exposure to SHS/THS was bad but they were not clear about how serious the consequences might be. Nonsmokers were concerned about being exposed to SHS and believed their exposure to SHS would cause sickness. A participant

(nonsmoker, female, 46) claimed SHS was even more harmful than smoking. Several participants reported they felt uncomfortable when people were smoking around them. Parents in the FGDs were aware of keeping their children away from smoking.

“I cannot tolerate it if more than one person is smoking; my eyes hurt.” (Female, 47)

“If I take my child out for dinner and there is someone smoking around, I will remind him of not smoking in the presence of kids.” (Female, 33)

Household smoking restrictions

Household smoking restrictions were commonly adopted by households with children and smokers living together, according to the participants. Generally, smoking was restricted when children were at present. To care for children, most smokers would voluntarily go outside to smoke. When someone smoked inside the house, mainly visitors, most participants would open the window for ventilation. In some families, smoke-free regulations were established. For example, smoking is only allowed on the balcony; or smoking is not allowed in the bedroom. Only one mother (nonsmoker, 43) complained that her husband and father would smoke regardless of the child, especially after dinner.

“I never see him [father] smoking at home; he would go outside to smoke.” (Female, 29)

“Our child was taken care of by my father-in-law when the child was young...he [father-in-law] was cooperative with us – he did not smoke at home; he might smoke outdoors.” (Nonsmoker, male, 31)

Challenges of smoking cessation

No intention or low motivation

Several participants stressed the importance of self-determination and will power for smoking cessation. It was argued that smokers usually do not think it necessary to quit. Most smokers did not perceive the risks were related to themselves and denied smoking negatively impacted their health. Smokers tended to have fluke mind – even though they heard a lot about

harm of smoking and cases of associated disease, they did not think the misfortune will happen to them, unless they finally get sick. They would refer to someone who smoked but was long lived as an excuse for not quitting, regardless of the potential health consequences supported by scientific evidence.

“It doesn’t matter whether your will [to quit] is strong or not; I do not intend to quit but I control the amount of smoking.” (Current smoker, male, 43)

“Some heavy smokers argue, when you persuade them to quit, that I am sick when I do not want to smoke.” (Female, 46)

In some cases, smokers relied on the effects of cigarettes. They resorted to smoke when they have to stay up late, and smoking kept them inspired and productive. An ex-smoker (male, 28) admitted he used to smoke when he was under stress and cigarettes brought him pleasure.

Addiction

The term “addiction to cigarettes” was frequently mentioned when talking about challenges of smoking cessation. Smokers did not believe it is possible for them to quit smoking, especially for those who had smoked for a long time.

Smokers who suffered from withdrawal symptoms and side effects, such as gaining weight, were more likely to give up. It also led to the assumption that it was wrong to quit smoking or not smoking determined health as well. Besides, participants mentioned once a smoker relapsed, their addiction became heavier and the amount of smoking increased. Therefore, smokers who relapsed after a previous quit attempt were reluctant to make another try.

“[My father] has smoked for decades; it is impossible for him to quit.” (Female, 33)

“As you know some heavy smokers are addicted; he feels sick when he was eager to smoke and will probably relapse.” (A male who tried smoking when young, 35)

Lack of support

Participants acknowledged it was not easy to always stay self-disciplined and lack of support

added to the probability of relapsing. Smokers who decided to quit need someone, family members or peers, to oversee their performance. In most cases, it was extremely difficult for smokers to quit if people around him continued to smoke since they would discourage him.

“We go to work respectively during the daytime; only stay together in the evening, ..., everyone in my husband’s company is a smoker; he cannot resist smoking, ..., I do not know how much he smokes [when I am absent].” (A participant whose husband is a smoker, 43)

Few participants recognized that there was pharmacological intervention available such as nicotine replacement treatment and professional guidance from specialists that can help smokers to address addiction and withdrawal management. Only one participant who works in the local CDC (nonsmoker, female, 46) knew there was a smoking cessation clinic that is accessible to the community.

High risk situations

Several participants pointed out in social activities and business occasions, it was sometimes embarrassing to refuse if others offered you cigarettes. However, once the abstinence was broken, it was hard to control smoking again. Habitual smokers reported unintentionally lighting a cigarette when they felt bored or stressed. Thus, it was essential to avoid high risk or trigger situations, such as hanging out with smokers, to prevent relapsing.

“I am able to control myself [not to smoke] in public areas, but when I stay alone and think about problems,, [I cannot resist smoking].” (Current smoker, male, 43)

“Unless you hide yourself at home and do not get in touch with other smokers, once you go out, even if you do not intend to smoke, others will persuade you [to smoke].” (Female, 43)

Barriers to household smoking restriction

Serval participants mentioned that older smokers did not recognize SHS had negative impacts on the health of people around them and they smoked whenever they wanted, ignoring their family’s request not to smoke around the child. Additionally, participants said it seemed

improper to restrict visitors to smoking in the home. Instead, they would take the child away. A mother argued the condition was better among the younger generation. In most cases, if there were children at present and you asked the smoker to put out the cigarette, they would understand and take your advice.

“It does not work for my father; he is stubborn, ..., you do not allow him to smoke at home, but he never listens to you because he, an old man, does not realize the harm.” (Female, 33)

“If the elder comes, ..., he certainly needs to smoke; we know his addiction and allow him to smoke... we just tell the child to go to another room” (A mother of a 7-year-old, 34)

Suggestions for adapting the SHI

We presented the existing SHI packet and explained how the intervention would be delivered. Participants were invited to make comments or provide suggestions to help revise the SHI to meet the context of their community.

We were suggested to specify the focus of each session as there were a series of contacts. In the discussions, participants emphasized that smoking cessation was not easy to accomplish so that instead of just informing the subjects of the harm of smoking, it was vital to offer feasible and effective methods to help them quit.

“It is infeasible to ask them [smokers] to quit at once, ..., it seems more possible to quit by gradually reducing the amount of smoking.” (A male who tried smoking when young, 35)

“It is unnecessary to explain; to tell them directly what to do – for example, they cannot smoke at home or they must take a shower after smoking, ..., they learned about the harm of smoking and soon they forgot – it is useless.” (A female whose father smokes, 29)

Considering some smokers did not believe smoking damages their health, it was essential to point out certain kinds of diseases they have were contributed by smoking. If the subject was completely healthy, this approach might work by giving examples of someone else that they know. Also, for subjects who thought it was impossible for them to quit, it was important to increase their confidence by referring to examples of people who have successfully quit.

Furthermore, to maintain abstinence and avoid relapsing, smokers need support and supervision. Therefore, the intervention should target at both smokers and their family. One participant (male, 58) mentioned some male smokers would get annoyed at his wife if she kept asking him to quit smoking. However, they would rather listen to their children's words.

“Family members usually have stronger wills [to have smokers quit], ..., there should be some punishments [if smokers break smoke-free regulations]”

To implement household smoking restrictions, a participant suggested to convince the smoker by showing some data about the health hazards among their children from SHS exposure (e.g. results of children's urine tests). The participant thought that by seeing a positive cotinine test results, parents and grandparents will more likely make behavioral changes.

In summary, we found smoking was prevalent in the study communities while most nonsmoking participants held negative attitudes toward smoking behavior and smokers. The challenges for smoking cessation, discussed by the participants, included low motivation, heavy addiction, and lack of support especially among smoking peers. Adopting household smoking bans were hindered by showing respect for elders and visitors. To implement the intervention, it helped to involve the whole family; and the counselling should be targeted at the subjects instead of being general.

3.2 Short-term effects of the SHI-R

3.2.1 Recruitment and follow-up

Four communities, two from Luqiao district and two from Linhai, were recruited in the RESCUE Study. In each district, one community was randomly assigned as the intervention and the other as control (as shown in figure1). Luoyang and Hetou were intervention groups;

Tongyu and Yongfeng were control groups. In all, 461 households (230 in control groups and 231 in intervention groups) completed the baseline assessment. At two months, the sample size available for analysis was 360 (78%).

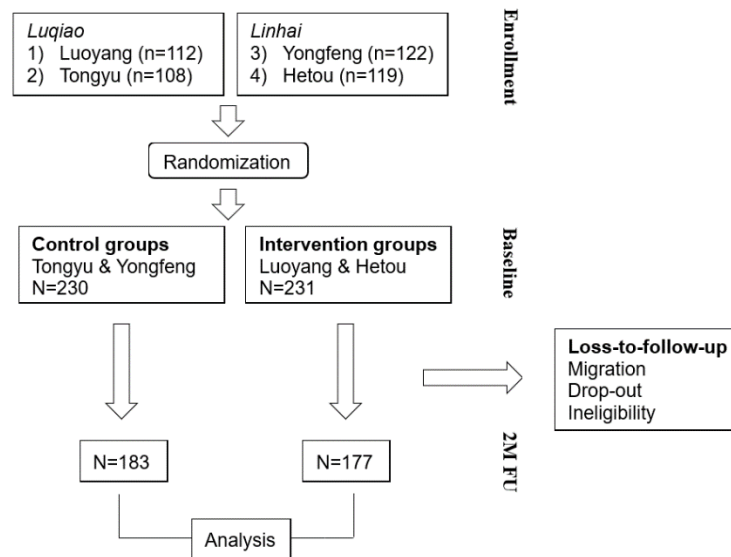


Figure 1. Flow of participants

3.2.2 Characteristics of the participants

Of the 461 smokers participating in the study, there were only 4 females. The mean age was about 45 (95% CI: 43.6, 46.2). Almost two-thirds of the smokers did not go to high schools. One quarter of the participants were farmers. Smokers in the households were mainly parents (61.5%) and grandparents (38.1%) of the children under age of 5. As shown in Table 2, except for the age of first smoking, there were no statistically significant difference between the subjects in the intervention and control groups (all P values > .05). Participants in the control groups appeared to be younger when they formed the habit of smoking (20 vs 22, P< .001).

Table 2. Characteristics of participants

		Control N=230		Intervention N=231		Chi square/t	P value
		n	%	n	%		
Gender	Male	226	98.7	228	99.6	1.01	0.32
	Female	3	1.3	1	0.4		
Age (Mean ± SD)		44.7 ± 14.5		45.2 ± 13.2		-0.36	0.72
Education	Middle school and below	147	65.0	150	66.7	0.13	0.72
	High school and above	79	35.0	75	33.3		
Employment	Farming	53	23.3	63	27.6	6.74	0.15
	Employed	79	34.7	86	37.7		
	Self-employed	51	22.4	49	21.5		
	Unemployed	22	9.7	9	4.0		
	Other	23	10.0	21	9.2		
Annual income (10,000)	<= 5	90	41.5	107	49.0	5.87	0.053
	5~11	81	37.3	83	38.0		
	> 11	46	21.2	29	12.8		
Relationship with the child	Parent	136	59.4	145	63.6	2.65	0.27
	Grandparent	91	39.7	83	36.4		
	Other	2	0.9	0	0.0		
Alcohol use	Never	100	44.4	88	40.7	0.78	0.68
	Not currently	48	21.3	46	21.3		
	Yes	77	34.2	82	38.0		
Age of first smoking (Mean ± SD)		20.3 ± 3.5		21.9 ± 5.3		-3.68	<0.001

3.2.3 Smoking behavior and household smoking hygiene practices at baseline

Smoking behavior of the participants in the study were measured by the timing of their smoking the first cigarette, the number of days they smoke in the past 7 days, cigarettes they consumed daily, and attempts of quitting smoking in the past year (Table 3). Two thirds of the participants smoked the first cigarette within an hour after getting up in the morning. The participants smoked nearly every day during the week before the day of interview. Generally, the smokers consumed 16 cigarettes per day (95% CI: 15,17). Less than a half of the smokers had ever tried quitting smoking in the past year. There were no group differences detected for all the variables regarding smoking behavior (P values > .05).

Household smoking hygiene practices included not smoking in front of children and not smoking at home. Smoking regulation referred to rules for restricting smoking of household members, that could be partial (i.e. not smoking in certain areas) or complete restriction. The difference between intervention and control groups in terms of smoking around children were statistically significant (P=0.03). A smaller portion of participants in the intervention group

would not be smoking when their children were at home (31.6% vs 41.3%). Over 90% of the smokers realized that they should smoke outside of the house but only a fifth of them always kept to the practice. About 50% of the households enrolled in the study had established smoking regulations. Nearly a half of the households had more than one smoker. A significantly higher proportion of participants (27.1%) in the intervention groups reported that visitors would smoke in their home compared to the control groups (19.1%, P=0.048).

Table 3. Measures of smoking behavior and household smoking hygiene practices at baseline

		Control N=230		Intervention N=231		Chi square/t	P value
		n	%	n	%		
<i>Smoking behavior</i>							
First cigarette in the morning	< 5 mins	41	17.8	29	12.9	2.13	0.35
	6-60 mins	114	49.6	118	52.4		
	> 60 mins	75	32.6	78	34.7		
Days of smoking in the past 7 days (Mean ± SD)		6.6 ± 1.3		6.5 ± 1.4		0.90	0.37
Daily cigarettes smoked (Mean ± SD)		16.8 ± 12.7		16 ± 10.8		0.75	0.46
Quitting attempts in the past year	Once	32	14.0	25	11.0	2.30	0.32
	More than once	74	32.3	65	28.5		
	Never	123	53.7	138	60.5		
<i>Household smoking hygiene</i>							
Smoking around children	No	95	41.3	73	31.6	4.68	0.03
	Yes	135	58.7	158	68.4		
Smoking outside the house	Never	10	4.4	18	8.0	4.51	0.34
	Seldom	32	14.2	35	15.5		
	Sometimes	76	33.6	73	32.3		
	Often	55	24.3	60	26.6		
	Always	53	23.5	40	17.7		
Household smoking regulation	No	124	53.9	114	50.2	0.62	0.43
	Yes	106	46.1	113	48.8		
Number of other household smokers	0	120	52.9	119	54.3	2.77	0.25
	1	97	42.7	83	37.9		
	>1	10	4.4	17	7.8		
Visitors' smoking at home	No	178	80.9	159	72.9	3.92	0.048
	Yes	42	19.1	59	27.1		

3.2.4 Intervention effects at 2 months

Effects of the intervention were measured by comparing smoking behavior and household smoking hygiene practices of participants in intervention and control groups at 2 months. Smoking cessation was the primary outcome, defined as not smoking during the 7 days preceding the 2-month follow-up, not even a puff, as reported by the participants. Only the subjects that were available to follow up at 2 months (78%) were included in the analysis. In

the intervention group, there were no significant differences between the remaining subjects and those were loss-to-follow-up in terms of their smoking behavior and household smoking hygiene practices at baseline.

Table 4. Measures of outcomes at 2-month follow-up assessment

		Control N=183		Intervention N=177		Chi square/t	P value
		n	%	n	%		
<i>Smoking behavior</i>							
Smoking cessation	Yes	14	7.7	13	7.3	0.01	0.91
	No	169	92.4	164	92.7		
		(N'=169)		(N'=164)			
		n	%	n	%		
Daily cigarettes smoked (Mean ± SD)		15.7 ± 11.5		14.1 ± 9.6		1.35	0.18
Quitting attempts in the past two months	None	136	81.9	130	79.8	0.26	0.88
	Once	17	10.2	19	11.7		
	More than once	13	7.8	14	8.6		
<i>Household smoking hygiene</i>							
Smoking around children	No	78	46.4	86	53.4	1.61	0.21
	Yes	90	53.6	75	46.6		
Smoking in the home	Never	18	10.7	34	20.9	18.34	<0.001
	Occasionally	43	25.6	63	38.7		
	Everyday	107	63.7	66	40.5		
Household smoking regulation	No	70	43.5	73	45.1	0.08	0.78
	Yes	91	56.5	89	55.9		
No behavioral change*	No	76	45.2	127	78.9	39.38	<0.001
	Yes	92	54.8	34	21.1		

*Including: quitting smoking, not/reducing smoking in the home/around children, restricting others' smoking around children

As shown in Table 4, only a little proportion (about 7%) of participants reported that they had successfully quit smoking and there was no significant difference between groups (P=0.91). When analyzing other variables listed in the table, we excluded the number of participants who no longer smoked. Although it seemed the participants who received the intervention performed better in terms of reducing the number of cigarettes they consumed daily (14 vs 16) and more of them making attempts to quit smoking (20.2% vs 18.1%) when comparing to participants in the control groups, the differences were not statistically significant (both P values > .05). The results were similar as what we found by using the intention-to-treat analysis, which was, differences of the two outcome variables - “smoking at home” and “no behavioral change” were significant.

The results showed that the intervention had positive impacts on household smoking hygiene

practices. A larger portion of smokers in the intervention group (78.9%) than control group (45.2%) had made behavioral changes to improve smoking hygiene in their households ($P < .001$). Additionally, a significantly higher percentage of participants ($P < .001$) in the intervention group (20.9%) never smoked inside the house in the past 2 months, compared to the control group (10.7%). There were no differences found in the outcomes of smoking around children and smoking regulation at home between groups (both P values $> .05$).

At baseline (Table 3), the proportion of participants who did not smoke around children was lower for the intervention groups. However, there was no difference in the same variable between groups ($P=0.21$) at 2 months, which indicated that a number of smokers who received the intervention adopted the practice of not smoking in front of their children.

Considering that smoking around children were different between groups at baseline, to examine the effects of the intervention, we presented the adjusted outcome measures in Table 5. The results were similar to what we got before the adjustment. There were no differences in terms of smoking behavior of participants in the two groups. The odds of not making behavioral changes in household smoking hygiene for participants in the intervention groups was 0.2 (95% CI: 0.12, 0.33) times that of participants in the control groups. The odds of smoking at home for smokers who received the intervention was 0.42 (95% CI: 0.22, 0.79) that of who did not.

Table 5. Measures of outcomes at 2-month follow-up assessment, adjusted for smoking around children at baseline

		Control n (%)	Intervention n (%)	OR (95% CI)
<i>Smoking behavior</i>				
Smoking cessation	No	169 (92.4)	164 (92.7)	1.03 (0.47, 2.28)
	Yes	14 (7.7)	13 (7.3)	
Reducing smoking	No	101 (55.2)	90 (50.9)	1.17 (0.77, 1.77)
	Yes	82 (44.8)	87 (49.2)	
Quitting attempts in the past two months	No	136 (81.9)	130 (79.8)	1.24 (0.71, 2.17)
	Yes	30 (18.1)	33 (20.3)	
<i>Household smoking hygiene</i>				
Smoking around children	No	78 (46.4)	86 (53.4)	0.64 (0.41, 1.02)
	Yes	90 (53.6)	75 (46.6)	
Smoking in the home	No	18 (10.7)	34 (20.9)	0.42 (0.22, 0.79)
	Yes	150 (89.3)	129 (79.1)	
Household smoking regulation	No	70 (43.5)	73 (45.1)	1.01 (0.65, 1.59)
	Yes	91 (56.5)	89 (55.9)	
No behavioral change*	No	76 (45.2)	127 (78.9)	0.20 (0.12, 0.33)
	Yes	92 (54.8)	34 (21.1)	

*Including: quitting smoking, not/reducing smoking in the home/around children, restricting others' smoking around children

To summarize, the intervention showed positive effects on improving household smoking hygiene practices, including not/reducing smoking in the home or in the presence of children. However, it had limited impacts on facilitating subjects' smoking cessation.

3.3 Individual interviews to learn health workers' experience

Two groups of health workers were involved in our study: ii) CHWs who are employees of primary health centers and ii) village doctors (VDs) who are general practitioners and run their own clinics in the village. In all, 7 CHWs and 5 VDs engaged in the implementation of the SHI-R and 10 of them were interviewed (Table 6).

Table 6. Characteristics of participants of individual interviews (N=10)

Characteristics		
Gender	Male	3
	Female	7
Age	Mean \pm SD	40.5 \pm 3.0
	Range	37-44
Education	College and above	8
	High school and below	2
Occupation	CHW ¹	5
	VD ²	5
Years of working	6 and above	4
	Less than 6	6

¹CHW=community health worker; ²VD=village doctor

We explored the experience of CHWs and VDs in delivering interventions and understand the challenges they encountered and four major themes emerged: perceptions of CHW-delivered intervention, challenges of delivering the SHI-R, effectiveness of the intervention, and suggestions for promoting the SHI-R. The findings were organized by subthemes where relevant (see Appendix D).

Perceptions of CHW-delivered intervention

Half (5/10) of the interviewees acknowledged that CHWs had advantages in delivering community-based health education. Registered primary public health workers are designated to serve a certain group of residents, in the form of a community or village. Usually, their areas of responsibility are also where they live. As a member of the community, they have built close relationships and trust with local people that facilitates their work. They are familiar with health conditions of the smokers so that they can offer specific suggestions to the targeted subjects.

*“We make home visits from time to time; they [subjects] are more likely [to take our advice]”
(CHW, female)*

“If you [the research team] are not accompanied by us [CHWs], it is kind of baffling and they [subjects] may deem you as frauds.” (VD, female)

As mentioned by one CHW, rural population were becoming more vigilant toward strangers

so that it was infeasible if the researchers themselves were to deliver the intervention. On the contrary, with frequent contacts, residents have trust in CHWs and they do not doubt the intention of the study. Moreover, local people generally communicate in dialects which adds difficulty for outsiders to reach them. Regarding the conflicts in meeting time, CHWs have more flexibility in doing the counselling after work, such as evening time.

Challenges of delivering the SHI-R

Adding workload

Public health is an important component of services provided by primary health facilities. However, due to a shortage of workforce, most CHWs are pluralistic. For example, one CHW in our study is a pharmacist, and another works at outpatient. Over half of the CHWs said they would no longer participate in similar projects since they struggled to handle the workload. Even though as a full-time employee of the public health department, a CHW (female, 13 years of experience) thought it beyond their duty to undertake the tasks of SHI-R .

“It is mainly because we have already got a lot of work; you bring one more, and then we are too busy.” (CHW, female)

Conflicts in time arrangements

VDs complained that doing the SHI-R influenced their own business. In most village clinics, there is only one doctor so that when he has to go for home visits, the clinic needs to be shut down and will cause inconvenience to the patients seeking healthcare.

“Sometimes it [doing the SHI-R] wasted my time; I went out for the whole morning and if someone wanted to get an injection, I had to tell him not to come.” (VD, male)

For CHWs, time conflicts also existed. It was almost impossible for them to meet the subjects in person during working hours. The targets of our intervention were smokers, mostly males who went out to work in the daytime so that CHWs had to make use of their personal time to

complete the counselling.

Incompliant subjects

Serval participants (6/10) complained about aggressiveness of some smokers when they raised the issue of smoking cessation. Although most of the subjects were friendly, encountering one offensive subject still made them upset and discouraged. Almost all (9/10) CHWs and VDs reflected the problem that the subjects tend to be impatient after more than one follow-ups. The health workers endured a lot of complaints about the intensive contacts.

“You suggested him to quit smoking, ..., he refused directly and argued that it was impossible [to quit smoking] as a businessman and let you go away.” (CHW, male)

Besides, two participants pointed out some subjects were likely to hide the truth. Some subjects were more straightforward, admitting there was inconsistency between his words and deeds. It was probable for the smokers to take the advice but never put it into practice.

Effectiveness of the intervention

Smoking cessation

Participants reflected that many smokers did not follow the quit smoking advice. 8/10 thought a large proportion of the subjects made no change in their smoking behaviors. They said smokers generally showed negative attitudes towards smoking cessation and had no intention to quit or even refused to receive counselling.

“It [the SHI-R] made no differences, ..., they [subjects] felt you kept telling them the same thing, but they did not quit.” (CHW, male)

Positively, CHWs observed a trend of reducing the amount of smoking. There were also a few successful cases: for example, a subject received counselling at the initial contact and he had already quit at 2-month follow-up.

Household smoking hygiene

Interviewees said that subjects responded more actively in terms of suggestions about reducing SHS exposure among children since parents were concerned about children's health. According to the CHWs, most households reported not smoking in front of children; some established smoking restriction at home at the follow-up; and caregivers, mainly mothers or grandmothers, were aware of not exposing the child to smoking environments.

"I told them not to smoke inside the rooms since it influenced their child's health, ..., they listened, listened to my words, instead of being offensive or indifferent." (CHW, female)

Other effects

The purpose of the SHI-R is to increase smoking cessation and reduce SHS exposure among children. Whereas, there emerged unintentional impacts. Firstly, with implementation of the intervention, there was increasing public awareness of risks of passive smoking in the community that contributed to protect children outside their homes. Secondly, the self-help materials we provided was useful to disseminate knowledge about smoking and SHS beyond the scope of our study. By putting up the smoke-free posters at home, when there came visitors, the subjects could share the pamphlets and recommend the smoking hygiene practices to other smoking households.

Nonetheless, other than benefits, the intervention was blamed for causing family conflicts. We did urine tests to measure children's SHS exposure. In scarce cases that children live with grandfathers who smoke, when the parents found the result of Cotinine detection was positive, they got angry at the smoker and forced him to quit smoking or move out of the house. The smoker refused, and it led to quarrels.

Suggestions for promoting the SHI-R

Workload was viewed as the primary concern to undertake the tasks of health intervention.

All participants suggested to simplify the SHI-R, including the number of contacts and length of each contact. They acknowledged that smoking cessation required long-term tracking to ensure the state of abstinence while it made the subjects rebellious if you pushed them too hard.

“It was unnecessary to have three follow-ups by telephone during the first month - once was enough.” (CHW, female)

In terms of the form of counselling, home visits or phone calls, the responses ranged. A few health workers considered face-to-face counselling worked better than telephone sessions while others thought the two had similar impacts. Most of them (8/10) agreed with our design of combining the two forms.

“I talked more in face-to-face sessions; it was unlikely for me to make the phone call too long.” (VD, female)

In addition, a CHW (female, 6 years of working experience) mentioned since they regularly paid home visits, she would embed the counselling with other community activities.

The health workers (including CHWs and VDs) acknowledged their role in delivering community-based health intervention, while it was disappointing as most of them said they would no longer participate in future or similar projects. According to the CHWs and VDs, although there were few in-compliant cases, most families took their advice in relation to reducing children’s SHS exposure. Whereas, it was more difficult for them to persuade the smokers into quitting.

4. Discussion

The mixed-method study examined perceptions of participants and CHWs, as well as short-term effects of a CHW-delivered intervention to promote smoking cessation and reduce household SHS exposure among young children in rural China. We found that with the increasing awareness of health risks of SHS, almost all participants would be willing to try to reduce children's exposure to SHS and many participants took actions by prohibiting smoking inside the home or around children. Zheng et al. (2014) claimed households with children less than 5 years of age were more likely to adopt a smoke-free home policy. Rather than completely smoke-free, most smoking households in the study would prefer to adopt a partial ban that allows smoking only in certain rooms at home. The living room, the kitchen, and the bathroom are the most regular places that smoking was allowed. Besides, common practices to address the issue of SHS included opening windows to let smoke escape or only smoking when no one else is at home (Zheng et al, 2014; Kegler et al, 2016).

In this study, reactions to the intervention (i.e. SHI-R) was positive among the participants. Although similar to a previous study (Alwan et al, 2011), there was no significant rise in smoke-free homes. Aligned with the goal of protecting young children from SHS exposure, we found for households with no ban on smoking at baseline, subjects would follow the advice to avoid smoking at home or in front of children at post-intervention assessments (Kegler et al, 2012; Blaakman, 2013; Abdullah et al, 2015). Nonetheless, consistent with findings in an earlier study (Winickoff et al. 2008), nonsmoking caregivers in the current study were more compliant with the intervention as they were more eager for help to improve household smoking hygiene.

At the follow-up, we found only few participants quit smoking, in consistent with the results

of a pilot study in the US (Kegler et al, 2012). However, a vast majority of smokers reduced the amount of daily cigarettes consumption. Even though the intervention was of high acceptability, considering that the participants reported to smoke on average 16 cigarettes every day, it might be difficult for them to quit immediately due to their high level of nicotine dependency and without the support of pharmacological therapy. Another potential barrier for achieving smoking cessation is the cultural view that favor smoking in China. Tobacco is widely acceptable in rural areas; and smoking is frequently referred as a tool for maintaining social networks (Abdullah, et al, 2012). As Rich and Xiao (2012) pointed out, cigarette gifting and sharing had adverse influence on current tobacco control efforts, and strongly contributed to smoking initiation as well as failure to quit smoking among Chinese.

4.1 Implications for policy and practice

4.1.1 SHS exposure reduction among children

Misconceptions regarding smoking behaviors were still prevalent in China (Ma et al, 2008); and ineffective measures such as smoking near windows or by fans that intended to remove impacts of SHS were widely adopted. Therefore, parents should have accurate perceptions of presence of tobacco smoke in children's environment (Rosen et al, 2018)

Decisions of smoking household members will directly determine young children's health as home is the primary source of SHS exposure among children under the age of 5. Nichter et al. (2015) suggested not smoking in the home could be effectively promoted as an important cultural value linked to male responsibility to protect the health of the family. Practically, mothers of the child were most often credited with initiating discussion regarding the

implementation of a smoke-free policy to address SHS exposure in the home (Berg, Zheng & Kegler, 2015). Hence, instead of targeting only at the smokers, interventions tailored to nonsmoking caregivers' concerns and needs are important to consider.

In China, especially in rural communities, it is typical for more than two generations living together. Older relatives and visitors who smoke were blamed as a main barrier to implement and maintain a smoke-free home policy (Zheng et al, 2014). In the Chinese value system, elder generations and guests are of high respect. Many parents faced sociocultural and environmental challenges for establishing smoke-free home rules, mainly due to their high respect for elderly and guests (Robinson et al, 2010). In our study, young parents acknowledged that they often felt reluctant to prohibit the elder from smoking in the presence of children. It might be deemed as impolite to restrict smoking in the home and even nonsmokers would provide guests with cigarettes (Wang et al, 2009). To address this cultural challenge, the enforcement of smoke-free policies in the workplaces and public places should be promoted that may result in a shift in social norms and ultimately in more voluntary smoke-free homes (St Claire et al, 2012).

4.1.2 Smoking cessation

Previous studies have shown that smoke-free homes were associated with increased cessation among smokers and decreased cigarette consumption (Pizacani et al, 2004; Mills et al, 2009). Our intervention contained both counselling for quitting smoking and reducing SHS in the home. The effects of the intervention turned out to be positive in terms of improving household smoking hygiene. However, it did not have significant impacts on smoking cessation. We found that most smokers had no intention or low motivation to quit smoking since they thought it was too difficult or even impossible for them to achieve complete abstinence. The main barrier they

referred to was the habitual nature of smoking or addiction to tobacco. Additionally, for smokers that had attempted to quit but failed, it was increasingly hard to persuade them that quitting is reachable since some of them reported to have experienced withdrawal symptoms, such as gaining weight, which made them relapse.

Motivational interviewing (MI) is a widely used strategy to deal with the problem. MI intervention showed positive effects on smoking cessation among low-motivated smokers in a few previous studies (Huang et al, 2015; Heckman, Egleston & Hofmann, 2010). Erol and Erdogan (2008) claimed behavior changes could occur when perceiving high benefits and low barriers. In our context, the primary motivation for smokers to change smoking behaviors was to reduce inverse effects of smoking and protect their children from SHS. To strengthen motivators among the smokers, it is important to emphasize hazards of tobacco use to themselves and to their loved ones (e.g. spouse, children), and to generate recognition of benefits of quitting.

In order to maximize the effectiveness of the intervention, it is necessary to discuss family support (i.e. engage women and children) in the conversation with smokers regarding smoking cessation and creating smoke-free homes. Participants of our study mentioned it was unneglectable that children could have significant influence on decision-making of the family. Huang et al. (2015) suggested family-assisted cessation intervention increased communication frequency and satisfaction. Also, positive and encouraging communication rather than criticism were recommended to be used. It is helpful to have family supporters read the self-help materials along with smokers.

For smokers who were heavily addicted, it might be useful to add pharmaceutical adjuncts along with counselling (Bhagabaty et al, 2015). Evidence supports that nicotine replacement

therapy and other medications (i.e. bupropion, varenicline) increase quit rate (Stead et al, 2012; Fiore, Jaen & Baker, 2008). However, cessation services have not been defined as one of the national prevention priorities in China and there is a lack of resources of professional advice of tobacco cessation in rural areas. Therefore, an alternative is to offer smoking cessation service through the Quitline.

Smokers can sometimes become aggressive when talking about smoking cessation. In our study setting (i.e. rural communities), smoking was a common and widely accepted practice and therefore it leads to smokers' unawareness of issues related to smoking and SHS. In this case, it is essential to use effective communication channels.

4.1.3 CHW-delivered health intervention

The study proved the feasibility and effectiveness of promoting household smoking in rural areas through community health workers (CHWs)-delivered intervention. Consistent with the findings of a qualitative study in China, using CHWs for delivering the intervention was acceptable to the public, as CHWs were described as trustworthy, friendly and a useful source of health information (Abdullah et al, 2012). Moreover, to provide counselling service at community level can be a solution to address the shortage of provision of primary healthcare workforce in most LMICs.

According to the narratives of CHWs that we interviewed, they perceived themselves to have advantages of being a member of the community and rapport building during their regular work. CHWs also had more flexibility in scheduling the counselling, especially in-person sessions, since they were able to meet working smokers after hours. Besides, speaking local dialects added efficiency to their communication with the participants. Besides, the role of CHWs

should not be limited to reinforcing the smoke-free home messages but also directing participants to the appropriate channels for more information (Alwan et al, 2011). Nonetheless, to rely on CHWs alone was not enough to help smokers quit, and thus messages of smoking cessation should be embraced and propagandized by multiple stakeholder groups including employers (Donna et al, 2014).

4.2 Implications for future research

4.2.1 Explore multi-media ways of intervention delivery

Possible interventions to promote smoking cessation and address SHS exposure included public education, community-level programs, clinical interventions, policy and advocacy statements, and legal and regulatory measures (Ashley & Ferrence, 1998). Although home visit was a central component to implement prevention priorities (Donna et al, 2014), participants in our study indicated the ways they learned information about smoking and SHS included social media, such as TV advertisement, posters in healthcare facilities, and subscribed articles on mobile applications. Thus, there is a need to initiate broad-based, integrated and sustained approaches to increase information to educate the general public about the consequences of tobacco consumption and of exposure to SHS (Abdullah et al, 2012; Zhu et al, 2006).

Based on the evolution of information technologies, there is a trend to combine traditional and mobile-phone-based education in the field of disease management and lifestyle changes, known as mHealth intervention. In China, the coverage of mobile phone users has expanded, allowing for the more accessible and efficient means of delivering health information. Earlier studies mainly utilize text-message service to advocate smoke-free homes and smoking

cessation among smoking households (Whittaker et al, 2012; Spohr et al, 2015). Findings of these studies demonstrated that addition of an mHealth element to interventions effectively aided in-person counseling and provision of educational materials (Yu et al, 2017). For future mHealth initiatives to promote smoking cessation, researchers may consider using other mobile platforms, such as WeChat (Lien & Cao, 2014).

4.2.2 Adapt the intervention design

Our intervention package was composed of intensive counselling during the first two months followed by brief contacts throughout the 6-month run. There were two face-to-face and four via-telephone sessions in all. In line with the study of Blaakman et al. (2013), it was challenging for us to engage participants to complete counselling contacts; and it was even more difficult to meet smokers in person, who went to work in the daytime. As reported by CHWs, participants became impatient after twice or three times of contacts. For future trials, it is necessary to explore multiple contact options; and for studies that last for a long period, it strongly requires persistence of the research team.

Design of the intervention are supposed to be culturally sensitive. To understand social context of the target community, it is useful to introduce the model of community-based participatory research (CBPR). The CBPR approach created a partnership between community members and researchers to help inform the intervention. Examples included a smoke-free initiative in India (Nichter et al, 2015) and a smoking cessation program in the US (Wagner et al, 2016) that aimed at recognizing barriers to adopt smoke-free rules, especially those originated from community norms. There are currently no CBPRs in China to address the issue of tobacco smoking and SHS exposure, and thus, future researches are expected to test

feasibility and effectiveness of the CBPR approach.

4.2.3 Address disagreements among family members

A prominent feature of households in rural China is to have extended family members, such as grandparents or uncles of the child, to live together. Thus, it adds difficulty to discuss and implement smoking hygiene practices and it sometimes even caused conflicts. According to the study by Abdullah et al. (2012), even though many non-smokers hated smoking, most were not able to initiate any restrictive measures in their homes. A study in India showed that there was limited success of initiatives proposed by women (Mittal & Das, 2011). The authoritative attitude of fatherhood was the main barrier for women to influence smoking ban adoption (White, Oliffe & Bottorff, 2012; Abdullah et al, 2012; Mao, 2013). Although in our study, due to love for young children, most participants were willing to obey smoking restriction in the home. Caregivers (usually mothers of the child) advised to take advantages of the power of the children. Alwan et al. (2011) indicated children felt confident in talking to their parents about the harms of SHS and negotiating with smokers in making their home smoke-free. Future studies should pay attention to power dynamics in the household and to ensure smooth enforcement of smoke-free rules.

4.2.4 Improve performance of CHWs

To deal with the shortage of healthcare workers, CHW-delivered programs are in great demand, particularly in LMICs. Hence, it deserves a focus of attention to investigate their working status. A variety of factors may have impacts on CHW's performance: for instance, individual motivation, amount of incentive, and community trust and recognition.

The lack of clarity on CHW roles, and a deficiency of supporting resources and logistics

undermined job satisfaction of CHWs. As CHWs are accountable to both the community and the health system (Kok et al, 2015), it leads to a heavy burden to the CHWs. Few CHWs we interviewed said they would participate in future studies as they encountered various challenges, such as extra workload, in compliant subjects, and complaints about continuous contacts. Escoffery et al. (2017) raised CHWs became discouraged with participants who were not willing to change immediately. Therefore, there is a need of future studies to explore potential methods to improve satisfaction of CHWs.

To address the concerns about workload, it may be helpful to enlarge the team of counselors to deliver counseling services and to arrange the period of intervention implementation upon consultation with counselors. In our study, each CHW or VD took charge of a village, usually with about 20 subjects, which could be a huge burden. Also, the time when we started the intervention was in June, middle of the year, that was the extreme busy season for the health workers. It is important for future studies to take these issues into consideration.

Training is of great significance to ensure the quality of intervention implementation and CHWs' performance. To become counselors of smoking hygiene intervention, it is essential to fill the CHWs' knowledge gaps regarding tobacco use and the need for communication skills (Glenton et al, 2013). As for long-term intervention (e.g. lasting for more than a year), to provide continuous training is necessary.

4.2.5 Ethical consideration

There are continuous debates about launching smoking bans at home. Criticism argued that prohibiting smoking in the home violated the rights of adults to smoke within private spaces (Phillips et al, 2007; Rowa-Dewar & Ritchie, 2014). There existed the misleading perception

that smoking was a stigmatized health behavior (Ritchie et al, 2009). Besides, competing with more immediate child protection concerns, such as alcohol, drugs, domestic violence and child abuse, researchers found it remained problematic to prioritize the children's protection from SHS exposure (Ritchie et al, 2015). It calls for continuous effort to emphasize hazards of tobacco use and clarify the necessity of smoking restriction to strengthen public awareness.

4.3 Study strengths and limitations

4.3.1 Strengths

Our study was the first to target at rural population in China to address SHS exposure issue among children living in the same household with smokers. Developed from previous studies, the SHI-R was innovative as it combined smoking cessation counselling with advice about reducing SHS exposure. To better fit the unique setting of rural communities, we adapted the existing intervention package before implementation. As suggested by most participants, we involved family members of the smoking subjects to have them support the smokers to change smoking behaviors and adopt smoking hygiene practices at home.

In terms of the study design, it was a clustered randomized controlled trial. On this basis, to reduce contamination between groups, we selected communities that were geographically separated. Besides, participants of the FGDs were members of the target community while they were not recruited in the trial to better avoid contamination.

4.3.2 Limitations

Although the study was well designed, it had a few limitations. First of all, to meet the inclusion criteria, we did not consider mobilization of residents in the selected communities. In

rural China, there is still a large group of people, usually young men, that were migrant worker. Therefore, it led to a high rate of loss-to-follow-up in our sample. Secondly, results of our study showed limited effects of the intervention since there were few significant differences of the indicators between the intervention and control groups. A potential explanation is that the baseline survey might have an influence on participants in the control group. As we asked questions of their smoking behaviors and children's health, they might get aware of the association between the two. Thirdly, as a clustered RCT and two communities separately consisted of the groups, we did not measure the differences between communities.

There were uncertainty occurring throughout the implementation process. Although we intended to control the quality and consistency of counselling delivered by different CHWs by using a manual and checklist, we could still not eliminate all differences. For example, our primary subjects were smokers so that the attendance of family members might not be ensured. Additionally, for households with more than a smoker, we only contacted the smoker that had more interaction with the child. To address the problem of multiple smokers, one possible solution is to restrict the number of smokers of eligible households.

5. Conclusion

In the study, to learn smoking patterns (including smoking behaviors and household smoking hygiene practices) and perceptions of smoking and SHS in the target community, we first interviewed the residents and revised the existing intervention packet based on their feedbacks. We found engagement of the whole household was of great importance to strengthen the effects of reducing SHS in the home. Family support was also beneficial to smokers' quitting.

Local community health workers and village doctors were trained to be the counselors. However, facing multiple working tasks, they felt it unmanageable to take charge of delivering the intervention. To utilize local human resources, as suggested by the engaged CHWs, it was important for future researchers to consider the workload that added to health workers and reasonably arrange time to avoid their busy seasons (i.e. middle or end of the year).

The findings of our study showed effectiveness of a CHW-delivered educational intervention to improve smoking hygiene around children in households in rural China. Whereas, the impacts of smoking cessation counselling were not significantly positive. Therefore, any future study should explore effective methods to achieve the goal of smoking cessation and to enlarge the scale of similar projects to protect children from being exposed to SHS.

Appendix A

Focus Group Discussion Topic Guide

Participants: 6

3 smokers and 3 non-smokers (Each group should include at least two female)

Time: 60-90 min

Topic 1: Smoking behavior

- 1) When did you start smoking? (How old were you at that time?)
Under what situation did you smoke for the first time? (With whom? Why?)
- 2) How many cigarettes do you smoke every day [on average]?
When do you usually smoke? (How do you feel when smoking?)

Topic 2: Knowledge about harm of smoking, SHS, THS

- 1) What do you know about the health consequence about smoking? [Will smoking influence your health? And what can these effects be?]
- 2) Have you heard about SHS/third-hand smoke (THS)? What is your views about SHS or THS? [if not, then explain what SHS/THS is]
[SHS: smoke from burning tobacco products, such as cigarettes, cigars, or pipes, or that has been exhaled, or breathed out, by the person smoking.]
[THS: the residual contamination from tobacco smoke that lingers in rooms long after smoking stops and remains on our clothes after we leave a smoky place.]
- 3) Do you know the effects of second-hand smoke on children's health? Can you list several specific effects?
- 4) Do you think children's health can be affected by exposure to THS? Can you list several specific effects?
- 5) What do you think about smoking in vehicles (i.e. private cars, Taxis)?
- 6) How much do you know about e-cigarettes? [*Probe*: do you know anyone who use e-cigarettes? Why do they use it? Have you ever thought of trying this?]

Topic 3: Preventing children from exposure to SHS

- 1) Are you concerned with your children's exposure to SHS? What do you concern about?
- 2) Have you tried to reduce your child's exposure to SHS? If so, how did you do it?
- 3) Many parents report that it is hard to prevent other family members (or visitors) from smoking around their kids.
 - 3.1 When do others smoke around your kids?
 - 3.2 How do you deal with this?
 - 3.3 Are you concerned when others smoke around your kid?

Topic 4: Quitting smoking attempts

- 1) Have you ever tried to quit smoking? Would you please tell me more about that process? [*Probe*: Who persuaded you to quit smoking; When/why did you try to

- quit smoking?]
- 2) What method(s) did you use to support your quitting?
 - 3) What went wrong on the past quitting attempts? What was the reason for you to start smoking again?
 - 4) If you are going to quit smoking in the future, what kind of help do you want to receive? (self-help materials, counselling, medication)? Would you be willing to pay any money from your pocket for these services/programs/medications?
 - 5) If you or someone in your family want to quit smoking, do you know where to get help for smoking cessation counseling and services?
 - 6) What is your impression about engaging community health workers (village doctor, explain in case they have no ideas about CHWs) to give counseling on children's SHS exposure reduction and parental smoking cessation? [*Probe*: how they can be good counselor/communicator; any negative issue]

[BREAK for 5-10 minutes, if possible]

Topic 5: SHI intervention

Now we want to discuss with you about an intervention program that we have developed to be delivered by CHWs. The intervention is designed to help parents and family members to reduce children's exposure to SHS and help parents quit smoking. Let me describe the intervention contents and the process of intervention delivery. We will appreciate your feedback to make the intervention more useful and relevant for your community.

PPT presentation for 5 minutes (process, number of times to be met in person/by telephone, topic to be covered).

[*Probe*: anything else to talk to make parents more willing to quit; frequency of contacts; other modes of delivery (i.e. WeChat use/text messaging); let them suggest what else to do]

Appendix B

Topic guide for individual interviews with CHWs

Purpose:

CHWs will be interviewed individually to help investigators better understand the difficulties and challenges they faced during intervention delivery, and to gather additional insights to improve the intervention.

When to interview:

After completion of the 2-month's intervention delivery.

Each interview will last for 30-45 mins.

- 1) Tell me about your experience in delivering the SHI intervention. What did you like and what you did not like?
- 2) What do you think of the workload? Is it too heavy or manageable?
- 3) Do you think that the intervention is well received by the participant?
- 4) Do you think the intervention works for your client to help them quit smoking or reducing SHS exposure to children?
- 5) Did the participants interacted with you when delivering intervention? (e.g. active interaction, passive attitudes, showed no interest)
- 6) What challenges did you face when delivering intervention? [Probe: What do you think about these challenges and how these could be avoided in the future?]
- 7) What suggestion do you have to improve the content or process of intervention? (what other changes do you think can better help your work? e.g. support from your peers, researchers?)
- 8) What do you think about your overall role in the project? [Do you think you have made a lot of efforts?]
- 9) Will you continue to participate in the project activities in the future, if there is a chance?
- 10) Would you recommend other CHWs to engage with the same intervention delivery for smokers and their family?

Appendix C

Themes emerged in FGDs

Themes	Subthemes
Perceptions of smoking	/
Concerns about SHS/THS exposure	/
Household smoking hygiene status	/
Challenges of smoking cessation	No intention or low motivation
	Addiction
	Lack of support
	High risk situations
Barriers to household smoking restriction	/
Suggestions for adapting the SHI	/

Appendix D

Themes emerged in individual interviews

Themes	Subthemes
Perceptions of CHW-delivered intervention	/
Challenges of delivering the SHI	Adding workload
	Conflicts in time arrangements
	Incompliant subjects
Effectiveness of the intervention	Smoking cessation
	Household smoking hygiene
	Other effects
Suggestions for promoting the SHI	/

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